Physics > Optics

Depth Profile of Optically Recorded Patterns in Light-Sensitive Liquid Crystal Elastomers

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We investigated nonlinear absorption and photobleaching processes in a liquid crystal elastomer (LCE) doped with light-sensitive azobenzene moiety. A conventional one-dimensional holographic grating was recorded in the material with the use of two crossed UV laser beams and the angular dependence of the diffraction efficiency in the vicinity of the Bragg peak was analyzed. These measurements gave information on the depth to which trans to cis isomerisation had progressed into the sample as a function of the UV irradiation time. Using a numerical model that takes into account the propagation of writing beams and rate equations for the local concentration of the absorbing trans conformer, we computed the expected spatial distribution of the trans and cis conformers and the shape of the corresponding Bragg diffraction peak for different irradiation doses. Due to residual absorption of the cis conformers the depth of the recording progresses logarithmically with time and is limited by the thermal relaxation from the cis to trans conformation.

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